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ORIGINAL ARTICLES

THE COMPARATIVE VALUE OF THE WASSERMANN, THE COLLOIDAL GOLD AND OTHER SPINAL FLUID TESTS: A STUDY OF 203 CASES.[1]

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Both clinical studies and laboratory investigations, especially in the past few years, have increased our diagnostic ability in organic nervous diseases to a marked degree. New methods and tests have been added in rapid succession. Since the introduction of the lumbar puncture by Quincke, in 1891, the examination of the spinal fluid has become more and more frequent, and at the present time *no neurologist* has scientifically completed his study of a *doubtful neurological case* unless he has made a thorough and comprehensive study of the spinal fluid.

The routine study of the spinal fluid comprises a cell count, a globulin test, a Fehling test, a Wassermann, a colloidal gold test and an examination for bacteria when indicated. In our work Dr. Riggs, Dr. Michael and myself have followed this routine examination as closely as possible in order to estimate the comparative value of the various tests in syphilitic and non-syphilitic diseases of the central nervous system. The cell count was made in the Fuchs-Rosenthal counting chamber and a diluting fluid containing methyl violet was used.

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[1] Thesis, read before the Minnesota Academy of Medicine, October 11, 1916.

In testing for increased globulin we used:

(*a*) *The Nonne Test.* By adding equal parts of spinal fluid with a neutral hot saturated solution of ammonium sulphate. Cloudiness within three minutes means a positive test.

(*b*) *Noguchi Test.* Take one part spinal fluid, add 4 parts 10 per cent. butyric acid, let come to a boil, add one part normal NaOH, let come to a boil. A positive test gives a flocculent precipitate within one-half hour.

(*c*) *Pandy's Test.* Take from 0.5 to 1 c.c. of a saturated aqueous solution of carbolic acid and add to it one drop of spinal fluid. The immediate formation of a bluish-white ring or cloud means an increased amount of globulin in the spinal fluid. For the most part these three reactions have been parallel. I personally prefer the Noguchi test, probably because I have used it more frequently than the others.

The Fehling Test. The Fehling test did not reveal anything of diagnostic value. It was positive in practically all cases.

The Colloidal Gold Test. This test was first introduced by Lange in 1912. Its principle depends upon the protective action of certain colloids, especially proteins, on the precipitation of gold suspensions by sodium chloride. Lange found that a 0.4 per cent. pure sodium chloride solution was of sufficient strength to keep the normal spinal fluid proteins in solution, but too weak to cause flocculation of colloidal gold solutions. In abnormal spinal fluids, on account of their high protein content, one naturally expected a greater degree of protection. However, this was not the case, and Lange observed that partial or complete precipitation of colloidal gold with resultant color changes was produced by these fluids with almost definite curves, especially from those spinal fluids of luetic origin. Fluids from tabes and cerebrospinal lues gave their maximal reactions in the lower dilutions, and this change has been so constant that it is spoken of as the "luetic zone" and "luetic curve;" fluids from the different types of meningitis gave reactions with their greatest intensity in the higher dilutions, commonly known as "Verschiebung nach oben;" fluids from paretics caused complete flocculation in the first four to six tubes with such regularity that Miller and Levy suggested the term "paretic curve." In Lange's original conclusions he states that normal cerebrospinal fluid produces no color changes in any dilution in the colloidal gold solution. Most workers, however, believe that slight color changes up to a purple color can occur in an absolutely normal spinal fluid. The colloidal gold test is very simple to perform, is readily interpreted, and requires only 0.2 c.c. cerebrospinal fluid. However, the preparation of the colloidal gold solution is most difficult. Frequently an apparently excellent solution is worthless. Miller and his co-workers have adopted the following standards:

29 My 44

1. The solution must be absolutely transparent and preferably of a brilliant red-orange or salmon-red color.
2. Five c.c. of the solution must be completely precipitated by 1.7 c.c. of a 1 per cent. sodium chloride solution in the time interval of one hour.
3. The solution must be neutral in reaction on the day on which it is used.
4. It must give a typical reaction curve with a known paretic cerebrospinal fluid.
5. It must produce no reaction greater than a No. 1, with a known cerebrospinal fluid.

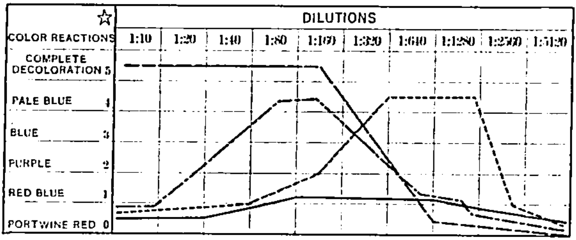
It frequently requires four or five attempts before a satisfactory solution is procured. The colloidal gold solution may be prepared in three different ways:

Lange's Method. Take 1000 c.c. of fresh doubly distilled water, add 10 c.c. of a 1 per cent. Merck's gold chloride solution and 10 c.c. of a 2 per cent. solution of K_2CO_3. Heat rapidly to the boiling-point, stir vigorously, and add 10 c.c. of a 1 per cent. solution of formalin. The colorless solution must at once assume a clear port-wine color.

Eike's Method. Take 1000 c.c. of fresh doubly distilled water, add 10 c.c. of a 1 per cent. solution of Merck's gold chloride and 5 c.c. of a 5 per cent. dextrose solution. Heat to 90° to 95° and then add a 5 per cent. solution of K_2CO_3, one drop at a time, until the required color is secured.

Oetiker's Modification of Eike's Method. Oetiker believed that the failures in procuring proper solution were due to two factors: (1) the variation in temperature, and (2) the variable amount of alkali solution added. He uses Eike's method; heats the solution to exactly 90° and without turning off the flame adds at once 12 c.c. of a 2 per cent. K_2CO_3 solution. With this method he has had no difficulty in getting satisfactory solutions. We have used most frequently Lange's method and of late Oetiker's modification of Eike's method; the latter is very satisfactory. The test is made as follows: Take eleven small test-tubes, carefully cleaned. In the first one put 1.8 c.c. of a fresh sterile 0.4 per cent. NaCL solution. In the remaining ten tubes put 1 c.c. of the same sodium chloride solution. To the first tube add 0.2 c.c. of the spinal fluid to be tested, making a dilution of 1 to 10. Mix thoroughly and transfer 1 c.c. from tube 1 to tube 2, again mix thoroughly and transfer 1 c.c. from tube 2 to tube 3, continue this process up to and including the tenth tube. This gives a series of dilutions ranging from 1 to 10 in tube 1 to 1 to 5120 in tube 10. Now add to each of the eleven tubes 5 c.c. of a satisfactory colloidal gold solution. Shake thoroughly and make readings in one-half hour and again in twenty-four hours. There is rarely any difference except of intensity between the half-hour and twenty-four-hour reading. The readings are tabulated in numericals from 0 to 5 : 0 meaning no color change; 1 a red blue; 2 a purple; 3 a blue; 4 a pale blue; 5 a complete decolorization.

The four typical curves are demonstrated in the following table:



—— No or slight change. Normal spinal fluid.
.... Meningitic curve or "Verschiebung nach oben."
-.-.- Leutic curve.
- - - Paretic curve.
Chart taken from article reference No. 16.

According to Lange the presence of blood in the spinal fluid causes color changes in the first four tubes. This is very important, for occasionally one procures a bloody spinal fluid, due to the lumbar puncture. We have repeatedly tested spinal fluids containing blood, either accidentally or added directly, in order to determine this point. Very small amounts of blood caused absolutely no change in the colloidal gold curve different from that produced by spinal fluid alone. However, when enough blood was present to make the spinal fluid distinctly hemorrhagic there was a marked color change in the first four to six tubes. This is in accord with Oetiker's observations. If a spinal fluid is kept sterile, age has no effect on the colloidal gold test. Oetiker examined a paretic spinal fluid which he had kept on ice for over one year. The same typical paretic curve was produced as at the first examination. However, Flesh has observed that in spinal fluids over eight days old the intensity of the colloidal gold curve is greater.

The Wassermann Test. In doing our Wassermann test we use for antigen an alcoholic extract of human heart. In our experience the cholesterinized antigen is so sensitive that we have obtained positive findings in apparently normal cases when other antigens also gave negative findings. Of course, there is the possibility of getting a negative test in weakly positive cases with an antigen similar to the one we use. We inactivate all sera, but use the spinal fluids direct in quantities from 0.02 to 1 c.c. In a few negative cases we have used larger amounts with rather unsatisfactory results.

This paper comprises the study of 203 cases: 43 paresis, 34 tabes, 27 cerebrospinal lues, 4 congenital lues, 11 meningitis, 3 tetanus, and 81 other non-luetic organic and functional conditions. In the luetic cases the report of the first examination is given before active antisyphilitic treatment was commenced. All the tests have been most intense and constant in general paresis.

GENERAL PARESIS—43 CASES.

Case No.	Wasserman.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
15	+	+	5543200000	+	+	64	
19	+	+	4555420000	+	+	92	
29	+	+	5554400000	+	+	24	
30	+	+	5555544432	+	+	106	
31	+	+	5543200000	+	+	42	
32	+	+	5554420000	+	+	12	
33	+	+	5455400000	+	+	16	
34	+	+	5554321000	+	+	29	
35	+	+	5555430000	+	+	83	
36	+	+	5555555555	+	+	37	Acutely maniacal type.
37	+	+	5554200000	+	+	44	
38	+	+	5555421000	+	+	9	
39	+	+	4554200000	+	+	32	
40	+	+	5555430000	+	+	12	
41	+	+	5554210000	+	+	17	
42	+	+	5532000000	+	+	115	
58	+	+	5544311000	+	+	62	
64	+	+	5555410000	+	+	6	
65	+	+	5544300000	+	+	34	
67	0	+	5554320000	+	+	23	
68	+	+	5554310000	+	+	29	
69	+	+	5544420000	+	+	81	
70	+	+	4554430000	+	+	37	
81	+	+	5555430000	+	+	63	
82	0	0	0122200000	Mild	Mild	14	Typical clinical paresis
112	+	+	5555554200	+	+	4	
122	+	+	5555432000	+	+	28	
126	+	+	4555420000	+	+	16	Frequent epilepsy.
136	+	+	5554320000	+	+	46	
139	+	+	5555543100	+	+	38	
150	+	+	5543300000	+	+	6	
154	+	+	5555420000	+	+	8	
161	0	0	5544410000	+	+	64	Grandiose type.
165	+	+	5554300000	+	+	14	
169	0	+	5544421000	+	+	28	
182	+	+	5543100000	+	+	16	
183	+	+	4555430000	+	+	22	
184	+	+	5555555555	+	+	78	Grandiose type.
191	+	+	5543100000	+	+	6	
196	+	+	5554310000	+	+	18	
198	+	+	5544320000	+	+	20	
201	+	+	5554321000	+	+	68	
202	+	+	4554300000	+	+	74	

The characteristic paretic curve of the colloidal gold reaction was found in 42 cases out of 43 spinal fluids examined. Case 82, a typical clinical case of paresis, gave normal blood and spinal fluid findings, and under antiluetic treatment intraspinally made an apparent clinical recovery up to the present time (ten months ago). He had contracted syphilis twenty-two years previous. It is quite possible that we were dealing with a case of cerebrospinal lues. Subsequent tests made after vigorous treatment showed no change from the first one. One case (No. 161) gave a typical paretic curve with a negative blood and spinal fluid. This case is one of the grandiose type and is clinically undoubted paresis. Case 36 (acutely maniacal type) and Case 184 (grandiose type) were interesting in that they gave complete decolorization in all dilutions. Four of our cases gave a negative Wassermann in the blood; all showed a marked positive globulin test; all but 5 had a lymphocytosis of over ten cells per cubic millimeter. In a study *of 130 cases of paretic spinal fluids,* Miller and his co-workers found a typical paretic colloidal gold curve 127 times. Of the three atypical reactions, 1 occurred in a very early case, 1 was probably due to an old and infected spinal fluid, and 1 was made after vigorous intraspinal therapy. Other workers do not place as much diagnostic value on this curve. Swalm and Mann and Solomon and Welles, although they found it present in a large majority of their paretics, question its true specificity.

TABES—34 CASES.

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
6	0	+	3343210000	+	+	16	
9	+	+	5554210000	+	+	38	No signs of paresis.
10	+	+	3334200000	+	+	8	
4	0	0	3443210000	+	+	3	Typical clinical case.
12	+	+	1233210000	+	+	16	
13	+	+	2334310000	+	+	6	
18	+	+	3443210000	+	+	23	
54	0	0	1232100000	0	0	3	Typical case with positive history.
56	+	+	4432100000	+	+	18	
57	+	+	3244210000	+	+	69	
59	+	+	2342123432	+	+	38	
60	+	+	3444310000	+	+	26	
62	+	+	4432100000	+	+	9	
63	+	+	5554321000	+	+	18	Suspected taboparesis
83	0	0	0122210000	0	0	3	Typical clinical case.
86	+	+	2343200000	+	+	79	
87	+	+	4433210000	+	+	16	
88	+	+	3444321000	+	+	8	
109	+	+	2344431000	+	+	19	
124	+	+	1234300000	+	+	6	
125	+	+	4433210000	+	+	32	
155	+	+	5342100000	+	+	8	
170	+	+	2344310000	+	+	26	Gastric crises only.
173	+	+	4432200000	+	+	18	
179	+	+	3344210000	+	+	36	
181	+	+	3334110000	+	+	28	
185	+	+	3444200000	+	+	6	
186	0	+	4322210000	+	+	18	
187	0	0	3444320000	+	+	9	
188	0	+	2223210000	+	+	3	
193	+	+	3443320000	+	+	12	
195	+	+	4342100000	+	+	36	
200	+	+	3443100000	+	+	94	

In our series of 34 cases of tabes we found a positive globulin test in all cases but 2, a lymphocytosis above ten twenty-two times, a positive Wassermann in the spinal fluids in all cases but 4, and a positive Wassermann in the blood in all but 7. There was a definite color change in the colloidal gold solution in the luetic zone in every case except one. In the majority of instances the color change occurred up to No. 4. This is more marked than occurs in cerebrospinal lues, but not sufficiently characteristic to be of much diagnostic value between it and tabes. Case 83 had been previously treated with salvarsan intravenously, had Argyll-Robertson pupil, loss of knee-jerks, shooting pains, and loss of bladder control. Both the blood and spinal fluid findings were normal. However, under further antispecific treatment intraspinally (Swift and Ellis) his lightning pains stopped and his bladder improved. Case 9 gave a typical paretic curve in the colloidal gold solution, but no clinical evidence of paresis. In Case 63, where we have another typical paretic curve, the patient showed evidence of memory impairment, which makes the probable diagnosis one of taboparesis. In Cases 54 and 187 all findings were negative except colloidal gold precipitation in the syphilitic zone.

CEREBROSPINAL LUES—27 CASES.

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
2	0	+	1232100000	+	+	16	
7	+	+	1332100000	+	+	9	
8	0	0	1233220000	+	+	21	Positive history.
20	+	+	1332100000	+	+	6	
28	0	+	2343220000	+	+	38	
66	+	+	5555420000	+	+	116	Apoplexy; no mental symptoms.
72	+	+	1232210000	+	+	8	
73	+	+	0123431000	+	+	16	Postmortem, gumma of brain.
80	0	+	1332210000	+	+	3	
84	+	+	2343210000	+	+	29	Major epilepsy.
85	+	+	4323100000	+	+	16	
112	+	+	1133420000	+	+	38	
119	+	+	2234300000	+	+	6	
120	+	+	1234200000	+	+	19	
121	0	0	1333320000	+	+	8	Positive history; typical case.
134	+	+	0133210000	+	+	4	
135	+	+	1233210000	+	+	16	
145	+	+	0123310000	+	+	5	
149	+	+	1334310000	+	+	22	
158	+	+	0234210000	+	+	12	
160	+	+	0122100000	+	+	8	
168	+	+	4555432000	+	+	42	
189	+	+	0123210000	+	+	16	
190	+	+	1334310000	+	+	4	
194	+	+	3332100000	+	+	96	
199	+	+	2334320000	+	+	18	
207	+	+	4543100000	+	+	68	

In cerebrospinal lues (27 cases) the globulin test was positive in all; there was lymphocytosis in 17 cases; the Wassermann in the spinal fluid was negative twice and in the blood negative 5 times. In all cases the colloidal gold test gave color changes in the syphilitic zone. In 3 instances there was the typical paretic curve without any clinical evidence of paresis.

CONGENITAL LUES—4 CASES.

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
71	+	+	5555431000	+	+	38	Juvenile paresis.
174	0	0	0100000000	0	0	3	After vigorous treatment.
175	+	+	0122100000	+	+	18	Associated with epilepsy.
92	+	+	1111210000	+	+	not done	Primaryopticatrophy.

Our 4 cases of congenital syphilis are too few to be of much value, except that they confirm Miller and Levy's conclusions, namely, that in the spinal fluid of congenital luetics the colloidal gold test shows nothing more definite in the majority of cases than the Wassermann. This is all the more interesting when one remembers there is a more positive Wassermann in congenital than acquired lues. In their conclusions, Miller and Levy state that the colloidal gold test has no advantage over known laboratory procedures in the diagnosis of congenital syphilis. However, Grulee and Moody, and also Johnston, in a recent publication, are not in accord with this.

MENINGITIS—11 CASES.

Case No.	Colloidal gold test.	Globulin.		Cell count.	Remarks.
		Nonne.	Noguchi.		
16	0001233110	++	++	96	Tubercles found in spinal fluid.
61	0002334100	++	++	116	Tubercles found in spinal fluid.
131	0133432110	++	++	286	Tuberculous meningitis postmortem.
152	0002333421	++	++	94	Tubercles found in spinal fluid.
162	0123322000	++	++	69	Tubercles found in spinal fluid.
203	0001221000	++	++	192	Clinical tuberculous meningitis.
105	0000133321	++	++	1260	Pneumococci found in spinal fluid.
108	0001234441	++	++	116	Pneumococci found in spinal fluid.
106	0022343111	++	++	492	Meningococci found in spinal fluid.
107	0013443200	++	++	612	Meningococci found in spinal fluid.
151	0000122100	++	++	1242	Meningococci found in spinal fluid.

In our meningitis cases (6 tuberculous, 2 pneumococcic, 3 meningococcic) all but two gave the characteristic "Verschiebung nach oben" in the colloidal gold test, namely, a decolorization in the higher dilutions, but the zone effected or the intensity of the reaction was not constant. The reaction usually becomes more marked as the disease progresses. All gave a marked globulin test and a cell count ranging from 94 to 1242 per cubic millimeter.

CEREBROSPINAL LUES ASSOCIATED WITH PNEUMOCOCCIC MENINGITIS.[2]

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
221	+	+	1124300000	+	+	12	
223	not taken		1121134421	+	+	Many leukocytes	Diplococci pneumoniæ in spinal fluid.

A case of cerebrospinal lues with a subsequent pneumococcic meningitis gave the above findings. The variations in the colloidal gold curve were interesting. The pneumococcic meningitis developed one month after the cerebrospinal lues.

TETANUS—3 CASES.

Case No.	Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
		Nonne.	Noguchi.		
204[3]	0003343200	Trace	Trace	4	
205	0000244310	Trace	Trace	8	
206	3443221000	++	++	Many	Hemorrhagic fluid.

In 3 cases of tetanus the spinal fluid findings were interesting in that the colloidal gold curve showed "Verschiebung nach oben" similar to meningitis. However, the other findings were negative. The Wassermann examined in Case 204 was also negative.

ACUTE ANTERIOR POLIOMYELITIS—4 CASES.

Case No.	Colloidal gold test.	Globulin.		Lymphocytes.
		Nonne.	Noguchi.	
207	1233210000	0	0	6
208	0000110000	0	0	2
209	0000000000	0	0	0
210	0000000000	0	0	8

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[2] Reported in full in Jour. Amer. Med. Assn., July 29, 1916.

[3] Wasserman in spinal fluid negative.

MISCELLANEOUS GROUP—76 CASES.

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
3	0	0	0000000000	0	0	6	Transverse myelitis.
1	0	0	0000000000	0	0	2	Hysteria major.
5	0	0	0000000000	0	0	0	Involutional melancholia.
14	0	0	0000000000	0	0	4	Syphilophobia.
17	0	0	0000123110	0	0	6	Spinal cord tumor.
21	0	0	0000000000	0	0	3	Epilepsy.
22	0	0	0000000000	0	0	0	"
23	0	0	0000000000	0	0	2	"
24	0	0	0000000000	0	0	4	"
25	0	0	0000000000	0	0	0	Friedreich's ataxia.
27	+	0	0000000000	0	0	2	Progressive muscular dystrophy.
43	0	0	0000000000	0	0	3	Manic depressive insanity.
44	0	0	0000000600	0	0	9	Manic depressive insanity.
45	0	0	0000000000	0	0	6	Manic depressive insanity.
46	0	0	0000000000	0	0	0	Manic depressive insanity.
47	0	0	0000000000	0	0	2	Manic depressive insanity.
48	0	0	0000000000	0	0	0	Manic depressive insanity.
49	0	0	0000000000	0	0	0	Manic depressive insanity.
50	0	0	0112100000	0	0	0	Manic depressive insanity.
51	0	0	0000000000	0	0	1	Manic depressive insanity.
52	. .[1]	. .[1]	0000000000	0	0	0	Manic depressive insanity.
53	0	0	0000000000	0	0	0	Manic depressive insanity.
56	0	0	0000000000	0	0	2	Familial spastic paralysis.
74	0	0	0000012220	0	0	6	Involutional melancholia.
75	0	0	5543100000	0	0	9	Multiple sclerosis.
110	0	0	0000000000	0	0	4	" "
212	0	0	0000000000	0	0	6	" "
216	0	0	0000000000	0	0	8	" "
76	0	0	0000000000	0	0	0	Mother of No. 71.
77	0	0	0000000000	0	0	2	Wife of No. 60.
78	0	0	0122220000	0	0	9	Sydenham's chorea.
79	0	0	0000000000	0	0	4	Huntington's chorea.
89	0	0	0000000000	0	0	6	Delirium tremens.
90	0	0	0112210000	0	0	8	" "
91	0	0	0111211000	0	0	5	" "
92	0	0	0000000000	0	0	4	" "
93	0	0	0112221000	0	0	2	" "
94	0	0	0000000000	0	0	3	" "
95	. .[1]	0	0000000000	0	0	9	" "
96	0	0	0000000000	0	0	7	" "
97	0	0	0222100000	0	0	8	" "

[1] Not done.

MISCELLANEOUS GROUP—76 CASES.—*Continued.*

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi.		
98	..[4]	..[4]	0000000000	0	0	1	Delirium tremens.
99	0	0	0000000000	0	0	3	" "
100	0	0	0000000000	0	0	0	" "
101	0	0	0000000000	0	0	2	" "
102	..[4]	..[4]	0000000000	0	0	0	" "
103	0	0	0000000000	0	0	6	" "
104	0	0	0000000000	0	0	0	" "
229	..[4]	..[4]	0112111000	+	+	..[4]	Fluid from cerebellar cyst.
113	0	0	0000000000	0	0	2	Acute alcoholism.
114	0	0	0000000000	0	0	0	" "
115	..[4]	0	0000000000	0	0	1	" "
116	..[4]	0	0000000000	0	0	3	" "
117	0	0	0000000000	0	0	0	" "
118	0	0	0000000000	0	0	2	Huntington's chorea.
127	0	0	0001223300	+	+	56	Spinal cord tumor.
128	0	0	0012100000	0	0	4	Dementia precox.
129	0	0	0000000000	0	0	2	Uremic convulsions.
130	0	0	0000000000	0	0	3	Syphilophobia.
132	0	0	0000000000	0	0	9	Cerebellar tumor.
133	0	0	0000000000	0	0	16	Meningismus.
137	0	0	0000000000	0	0	9	Acute mania.
138	..[4]	..[4]	0000000000	0	0	8	" "
141	0	0	0000000000	0	0	8	Uremia.
149	0	0	0000000000	0	0	83	Meningismus.
143	0	0	0112221000	0	0	4	Bell's palsy.
146	0	0	0000000000	0	0	2	Migraine.
148	0	0	0000000000	0	0	0	Trifacial neuralgia.
153	0	0	0122210000	0	0	12	Brain tumor.
157	0	0	0000000000	0	0	3	Myasthenia gravis.
159	0	0	0000000000	0	0	1	Brain tumor.
163	0	0	0000000000	0	0	4	Cerebral palsy of childhood.
166	0	0	0000000000	0	0	4	Bell's palsy.
172	0	0	0023455555	..	..	2	[5] ? ?
178	0	0	0000000000	0	0	0	Myasthenia gravis.
219	0	0	0000000000	0	0	2	Wife of tabetic.

Spinal fluids from acute anterior poliomyelitis gave nothing definite. All were obtained during the acute stage of the disease. One case (No. 207) gave a colloidal gold curve in the luetic zone. Johnston found this present in 4 cases during the acute stage. He subsequently examined 2 of these after acute symptoms had subsided and in both the colloidal gold curve was negative. He beleves that this occurrence of an early transitory reaction in the syphilitic zone in the acute stage of anterior poliomyelitis suggests an important aid in the diagnosis of this disease.

In our miscellaneous group (76 cases) all findings were practically normal. The Wassermann in the spinal fluid in all cases was negative. One blood gave a positive Wassermann, the cell count was normal except in 2 cases of meningismus, in 1 brain tumor and in 1 spinal cord tumor; the globulin test was negative in all but 1. The colloidal gold test showed nothing definite, except occasionally a slight decolorization in the lower dilutions. In 3 cases of multiple sclerosis all findings were negative, but in 1 case (No. 75) the colloidal gold test showed a typical paretic curve with a negative Wassermann test. Similar findings have been reported. Miller and his co-workers report 3 cases; Flesh observed this curve 6 times out of 8 cases examined. Kaplan found it only once in 18 cases; Oetiker reports 1 case. The presence of a "paretic curve" with the other spinal fluid findings negative might be of help in the diagnosis of suspected multiple sclerosis. Occasionally one sees a report of a "paretic curve" with normal spinal fluid findings in other conditions. Oetiker observed this in a case of puerperal eclampsia; Miller in a brain abscess and in a case of cirrhosis of the liver. Case 172 gave interesting findings. The spinal fluid was slightly hemorrhagic (old hemorrhage) and contained an excessive amount of globulin. The patient had an old Pott's disease of seventeen years' duration, and during the past few months gradually developed a transverse myelitis with a flaccid paralysis. Both spinal cord tumor cases (Nos. 17 and 127) gave a decolorization in the higher dilutions.

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[4] Not done.

[5] Transverse myelitis associated with Pott's disease; spinal fluid showed xanthocromia at three separate lumbar punctures.

SPINAL FLUID FINDINGS AFTER TREATMENT, WHERE ALL TESTS SHOWED IMPROVEMENT.[6]

Case No.	Wassermann.		Colloidal gold test.	Globulin.		Lymphocytes.	Remarks.
	Blood.	Spinal fluid.		Nonne.	Noguchi		
37	0	+	3321000000	0	0	4	Paresis.
9	0	0	1232100000	0	0	2	Tabes.
179	0	0	2231000000	0	0	3	"
193	0	0	0000000000	0	0	1	"
186	0	0	1223200000	0	0	7	"

The effects of antiluetic treatment on these tests have been variable. In the main our syphilitic cases have been treated with salvarsan, intravenously and intraspinally (Swift and Ellis method), combined with mercury. In all cases there has been a gradual reduction of the cell count to normal. In the majority of cases the globulin test has become normal while in some it remained slightly positive. In 21 cases of paresis, treated thoroughly, all but 2 gave a negative blood Wassermann. However, in the spinal fluid it persisted positive in every case. Out of 22 cases of tabes treated, 16, or 73 per cent., gave a negative Wassermann both in the blood and spinal fluid. In only 5 instances of all antiluetic cases treated did we notice any change in the colloidal gold curve, and in only 1 case did the curve become normal.

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[6] For original findings refer to same case numbers in early part of this paper.

SUMMARY. 1. The most constant finding in a pathological spinal fluid is a positive globulin. It is indicative of an inflammatory process, but is of no specific import.

2. Pathological cerebrospinal fluids usually show some lymphocytosis. However, the number may be normal. Fluids from cases of meningitis almost invariably give a high cell count.

3. As an index of pathological change in the cerebrospinal fluid the colloidal gold reaction is more delicate than any other test here employed.

4. Normal spinal fluid usually causes no reduction of the colloidal gold. A slight reduction in any of the dilutions is of no diagnostic import, and may occur in normal spinal fluids.

5. Cases of tabes and cerebrospinal lues gives a typical colloidal gold curve in the luetic zone. Although in tabes the intensity of the curve is usually greater, it is not sufficiently constant to be of diagnostic value between the two conditions.

6. In paresis the colloidal gold test is sufficiently frequent and characteristic to warrant the term "paretic curve," and is of great diagnostic value. However, it has been observed in cases of tabes, cerebrospinal lues, multiple sclerosis, brain abscess, and once in puerperal eclampsia.

7. In meningitis the colloidal gold curve usually occurs in the higher dilutions, and is probably of value in the diagnosis of doubtful cases.

8. In spinal fluids with normal findings, except a paretic colloidal gold curve in doubtful cases, the possibility of a multiple sclerosis must be strongly considered.

9. The colloidal gold test is more delicate than the Wassermann test. Spinal fluids from luetics have given a colloidal gold luetic curve with a negative Wassermann. However, we have never observed a normal colloidal gold curve with a positive Wassermann in the spinal fluid. Exceptions to this are the congenital luetics.

10. Under antiluetic treatment there is usually a reduction in the cell count and globulin of the spinal fluid; frequently the Wassermann becomes negative; rarely is there a change in the colloidal gold test.

11. No spinal fluid test (except the presence of bacteria) is specific. Every test is simply that much coöperative evidence and should be combined with the history of the case and the clinical findings.

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CONCERNING THE CAUSATION OF EDEMA IN CHRONIC PARENCHYMATOUS NEPHRITIS: METHOD FOR ITS ALLEVIATION.[1]

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ONE of the most striking clinical manifestations of chronic parenchymatous nephritis is the development of edema or anasarca. Its occurrence is intimately associated with a diminished elimination of salts and water, believed to be due to a reduced power of the kidneys to excrete these substances. Those who have had occasion to observe the condition know well the severe proportions which it may assume, the distress which it causes the patient, and the inadequacy of medicinal treatment or the usual dietetic restrictions.

The present communication forms part of a larger study on nephritis begun a number of years ago. Its purpose is to put on record certain facts concerning the nature of the anasarca occurring in chronic parenchymatous nephritis which are of clinical importance and to suggest a new method of treatment which promises to be useful. The reason for selecting this particular phase of the subject is the conviction (gained in the study) that the edema, or anasarca, is one of the most important phenomena in the disease, and that by its alleviation and prevention great progress is made toward ultimate relief of the renal condition.

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[1] Read before the Section on Medicine at the New York Academy of Medicine, October 17, 1916.